THE EFFECT OF POSSIBLE DEFICIENCIES IN THE RATION OF SOWS, ON THE STRUCTURAL ELEMENTS OF THE BLOOD OF THEIR PIGS

BY

THOMAS JOHN JONES

B.S.A., University of Florida, 1931
D.V.M., University of Georgia, 1933
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AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ANIMAL HUSBANDRY
IN THE GRADUATE SCHOOL OF THE
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Introduction

Many workers have been concerned with the fact that a very large percentage of pigs that are farrowed from apparently normal, healthy sows do not survive to reach weaning age, or until such time as they can eat and digest sufficient feed for their development.

About thirty-five to forty per cent of all pigs die before reaching eight weeks of age, even under average or good management. If the sows or gilts that farrowed them are confined to dry lot conditions and are not given access to some kind of green feed such as alfalfa, brome or rye grass, the percentage of pigs weaned falls still lower and may be as low as ten to twenty per cent of the pigs farrowed. If the sows or gilts are given access to pasture during gestation, or if they are fed relatively large quantities of alfalfa meal in the ration, they apparently store sufficient nutriment materials in the body to supply the young pigs with the necessary elements from birth to approximately four weeks of age. Sows and gilts have been fed certain rations[1] in dry lot continuously from birth. The results of their gestation and lactation performance were very unsatisfactory and uneconomical. On the other hand, sows and gilts given access to pasture were able to adequately nurse their pigs and wean a relatively large number of pigs farrowed. This study is concerned chiefly with the blood picture[2] of pigs farrowed from sows that were kept under dry lot conditions and compared with pigs from sows having access to rye pasture or fed a vitamin supplement in the ration.

[1]Table of Rations Fed, page 6.
[2]Table of Means, Types of Erythrocytes, page 7.

Experimental

The experimental work comprised two series of experiments; one conducted during the fall months of 1944 and the other during the spring farowing season of 1945. The 1944 experiment consisted of three lots of six gilts each, confined to dry lot since birth and fed the following ration: ground yellow corn, 71% ; soybean meal, 18% ; tankage (50% protein meat and bone tankage), 5% ; alfalfa meal, 5% ; iodized salt, 0.5% ; and fortified cod-liver oil, 0.5%. Lot I was fed the above basal ration; lot II was given in addition to the basal ration 1% of a riboflavin supplement; and lot III was fed the basal ration plus 2% of the riboflavin supplement.

In the 1945 spring experiment six lots were used. The rations and treatment of each lot is herein presented in table form. The six crystalline B-vitamins were added to lot I in the following amounts: 150 mgm. of thiamin, 150 mgm. of riboflavin, 500 mgm. of niacin, 600 mgm. of pantothenic acid, 250 mgm. of pyridoxine and 150 grams of choline chloride per 100 pounds of ration. As shown in the table, the protein supplement used in lots I, II and III was largely of animal origin while in lots IV, V and VI the supplement was of plant origin. The ration in lots IV, V and VI contained 25% soybean meal. Blood was taken from each pig once weekly during the 1944 fall experiment and twice weekly during the 1945 spring experiment. Hemoglobin content in grams per 100 cc. was determined, also the red blood cells in millions per cmm. Duplicate slides were made at the time of bleeding and the slides stained according to Giemsa's method. An extensive study of the erythrocytes was conducted and the results presented in tabulated form. A table of means is presented to show the percentage of types of erythrocytes found in this study.

The heading of each column is self explanatory except that under anisocytosis, three types of cells are grouped, macrocyte cells measuring 9-12 microns, megalocyte cells

measuring 12-16 microns and microcyte cells measuring 5-9 microns. The majority of all cells classified under anisosocytosis were of macrocyte type. Differential counts of white cells was begun but since there was no apparent deviation from normal in the counts, the study was discontinued. There was no apparent difference in white cells between the 1944 fall experiment and 1945 spring experiment, neither was there an appreciable difference between any of the lots in either experiment.

Results and Discussion

Since physiological anemia of young animals may be aggravated due to a lack of iron in the diet and a lack of iron had to be ruled out, each sow's udder was swabbed once daily with a saturated solution of ferrous sulfate. The results of the 1944 experiment as presented shows that all 3 lots had an inadequate ration. The percentages of pige weaned were: Lot 1, 9; lot II, 10; and lot III, 21. The erythrocyte study indicates a greater degree of anemia present in lot I as the normal erythrocyte count is 67.7%, lot II 69.0%, and lot III 73%. The difference although not very large numerically corresponds to the treatment and it might be concluded that the rations fed did not supply the necessary elements for adequate formation of normal erythrocytes. The erythrocyte count and the hemoglobin estimations follow the same trend, that is, slightly lower in lot I and gradually increasing in lots II and III.

The results of the 1945 spring experiment are slightly more consistent and show less marked differences than those found in the 1944 test. The normal erythrocyte count and hemoglobin content as given in text books (Dukes' Physiology) are 7,400,000 erythrocytes per cmm. of blood and 11.95 grams of hemoglobin per 100 cc. of blood. The control group, lot VI, gave values of 7,580,000 for erythrocytes and 11.44 grams for hemoglobin. Therefore, one can see that the controls had nearly normal values. A glance at the

accompanying table shows that lot IV had the lowest percentage of normal red blood cells and this lot showed the poorest performance in percentage of pigs weaned, 26%. The number of pigs weaned is still the criterion that is most often used in measuring the efficacy of a ration. Accordingly the percentages of pigs weaned are tabulated under the types of erothrocytes found. These values show some correlation between the number of normal erythrocytes in the blood of pigs and their ability to survive.

Conclusions

1. Neither one per cent nor two per cent of a riboflavin supplement was sufficient to correct deficiencies in two rations composed of natural feeds commonly fed to sows during gestation and lactation.

2. The addition of the crystalline B-vitamins corrected to a considerable extent, but not completely, the deficiencies of the animal-protein ration.

3. The same is true of dried skim milk fed as 10% of the ration.

4. The deficient factor (or factors) is present in sufficient amounts for economical performance in rye pasture and in distillers' solubles and fish solubles when fed in combination with 4 and 5% of alfalfa meal, respectively.

5. They are apparently present in too limited quantities in 5% alfalfa meal alone.

6. The erythrocyte number and the hemoglobin content of the blood of young pigs are below the requirements of the animal if the dam is fed a qualitatively inadequate ration.

7. The data presented indicate that the nearer complete the rations of the sows, the more normal will be the erythrocyte count and the hemoglobin value of the blood of their pigs.

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RATIONS FED DURING GESTATION AND LACTATION

1945 Spring Experiment

Lot number	1	2	3	4	5	6
Treatment	6 crystalline B-Vitamins	10% dried Skimmilk	6% distillers' solubles+4% alfalfa meal	5% dehyd. alfalfa meal	5% dehyd. alfalfa meal + 6% sardine fish solubles	rye pasture
Ration number	102A	102B	103B	123	123 + 6% fish solubles	123 + rye pasture
Ingredients:						
Ground yellow corn	83.0	79.0	77.0	67.0	94% of ration 123 plus 6% sardine condensed fish solubles	Ration No. 123 plus access to rye pasture
Soybean meal	8.0	5.0	4.0	25.0		
Tankage	6.0	2.0	6.0			
Fish meal	2.0	2.0	2.0			
Dried corn distillers' solubles			6.0			
Dehyd. alfalfa meal			4.0	5.0		
Dried skimmilk		10.0				
Steamed bone meal		1.0				
Iodized salt	0.5	0.5	0.5			
H & K Minerals				2.5		
Fortified cod-liver oil	0.5	0.5	0.5	0.5		
Est. Composition of Rations:						
Crude protein, %	15.0	15.0	15.0	17.0		
Calcium, %	0.77	0.79	0.80	0.74		
Phosphorus, %	0.68	0.68	0.68	0.49		
Manganese, p. p. m.	39	38	43	46		
Riboflavin, mg. per lb.	2.23	1.55	1.49	1.18		
Niacin, mg. per lb.	13.88	7.21	11.45	9.59		
Pantothenic acid, mg. per lb.	9.72	4.84	4.70	4.65		

TABLE OF MEANS LOT I-III
Types of Erythrocytes
Fall 1944 Experiment

	Normal RBC %	Normoblasts %	Anisocytosis %	Hypochromia %	Polychromasia %	Poikilocytosis %
Lot I	67.787	.042	7.458	7.798	6.502	10.413
Lot II	69.000	.056	5.222	6.667	4.444	14.611
Lot III	73.150	0	5.475	4.675	5.475	11.225

TABLE OF MEANS LOT I-VI
Spring 1945

Lot I	74.787	.040	4.747	4.606	4.447	11.373
Lot II	74.884	.032	4.465	5.064	4.763	10.792
Lot III	74.760	.027	4.947	5.746	4.947	9.573
Lot IV	70.152	.019	5.829	6.391	5.780	11.829
Lot V	85.660*	.040	2.960	2.400	2.240	6.700
Lot VI	76.634	.0	4.425	4.658	4.433	9.850

PERCENTAGE OF PIGS WEANED
1944 Fall

Lot I—9 Lot II—10 Lot III—21

1945 Spring

Lot I—89 Lot II—40 Lot III—70

Lot IV—26 Lot V—71.0[1] Lot VI—74

*Samples taken from sixth to eighth week.

[1]Because of large litters, eight per cent (5 pigs) of the pigs farrowed were removed and placed with other sows not on the experiment.

VITA

Thomas John Jones was born in the village of Llanstephan, County of Carmarthen, Wales, Great Britain, on November 26, 1903. He attended public and secondary schools in Wales and graduated from grade school in 1916, and secondary school in 1920. He immigrated to the United States of America in 1926 and attended Penny Farms Agricultural Institute 1926-27. He entered the University of Florida in 1927 and graduated with a B. S. A. Degree in 1931. He attended the University of Georgia 1931-33 and graduated with Degree of Doctor of Veterinary Medicine. He practiced veterinary medicine fro m1933 to 1936. He entered Government Service, Bureau of Animal Industry 1937-39. He accepted position as Assistant Professor of Animal Husbandry at the University of Georgia in 1939. He received Master of Science in Agriculture Degree there in 1943, and was promoted to Associate Professor. He entered the University of Illinois as graduate student 1944-45. He returned to the University of Georgia in 1945 as Associate Professor and was promoted to Full Professor in 1947. He is a member of Phi Sigma, XI Phi XI, and Phi Kappa Phi. He is also a member of Georgia Academy of Science and the American Veterinary Medical Association.

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